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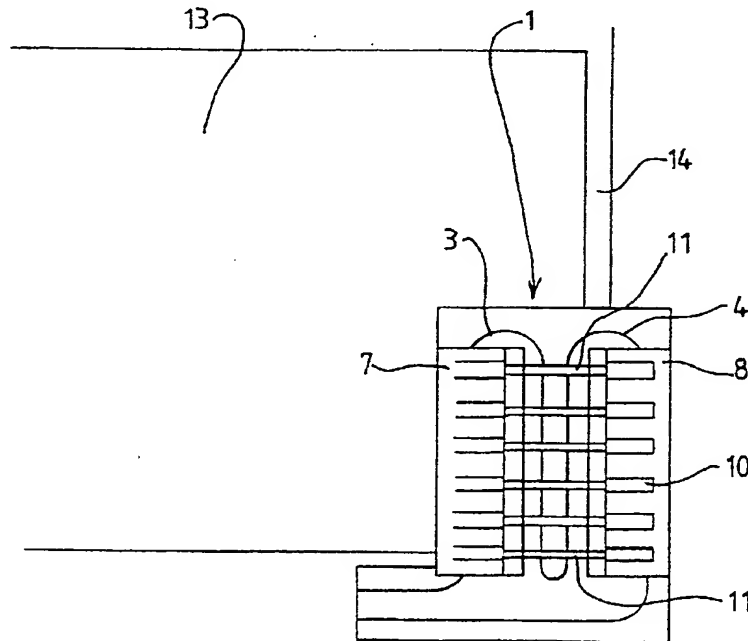
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[Continued on next page]

(54) Title: AN AIR-BAG ARRANGEMENT



(57) Abstract: An air-bag (1) is provided which, when inflated, is intended to be located adjacent the A-Pillar (14) on a motor vehicle. The air-bag comprises two inflatable chambers (3, 4). Mounted on the air-bag are a plurality of parallel plastically deformable struts (11), the opposed ends of which are retained in retainers (10) constituted by pockets formed on flaps (7, 8) mounted on the air-bag. A pedestrian striking the motor vehicle will be packed with the slats which will deform plastically to absorb energy, and which will also yield as the air-bag becomes compressed with a load distributing effect.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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"AN AIR-BAG ARRANGEMENT"

10 **THE PRESENT INVENTION** relates to an air-bag arrangement, and more particularly relates to an air-bag arrangement for use on a motor vehicle.

If a pedestrian is hit by a motor vehicle, such as a motor car, the pedestrian may be severely injured, especially if the pedestrian impacts with
15 specific areas of the car which are very rigid, and consequently dangerous. An area which is particularly dangerous is the area of the vehicle in the region of the A-Pillar, including the part of the windscreen that is adjacent the A-Pillar, and adjacent the upper part of the scuttle. It has also been found that should the hood or bonnet deform during an impact with a pedestrian so that the under-
20 surface of the hood or bonnet comes into contact with the engine block or the mounting points for the front suspension of the vehicle, the hood or bonnet can be deformed no further, and then the pedestrian who is deforming the hood or bonnet may suffer severe injuries.

25 It has been proposed, therefore, to provide arrangements within a motor vehicle adapted to lift the rear part of the hood or bonnet in the event that an impact with a pedestrian should occur, thus spacing the hood or bonnet from the engine block and the mounting points for the front suspension, permitting a substantial deformation of the hood or bonnet to occur before the hood or

bonnet actually contact the engine block or front suspension mounting points. Also it has been proposed previously to provide an air-bag which, on inflation, is intended to cover the A-Pillars.

5 Difficulties have been encountered in designing an air-bag for use to cover the A-Pillars of a motor vehicle. The air-bags must have a substantial size, and the gas pressure within the air-bag must be relatively high, since otherwise the head of a pedestrian striking part of the air-bag would simply compress that part of the air-bag enabling the head of the pedestrian to strike
10 the A-Pillar. However, if the pressure within the air-bag is high, there is a substantial risk of "rebound" occurring, with the head of a pedestrian striking the air-bag rebounding away from the air-bag in a very undesirable manner which can impart substantial injuries to the pedestrian. Some air-bags are provided with ventilating apertures to prevent "rebound", but such ventilation
15 apertures would not be appropriate in an air-bag intended to cover an A-Pillar, since the presence of such ventilation apertures would increase the risk that the head of a pedestrian would actually strike the A-Post. Also, it is preferred that air-bags of this type should remain inflated for a relatively long period of time as compared with a typical air-bag within a vehicle, again making ventilation
20 apertures undesirable.

The present invention seeks to provide an improved air-bag arrangement.

25 According to this invention there is provided an air-bag arrangement on a motor vehicle, the air-bag arrangement incorporating an air-bag and a gas generator to inflate the air-bag, the air-bag being configured and located so that when the air-bag is inflated, it extends at least partially over an A-Pillar of the motor vehicle, the air-bag being provided with a plurality of elongate

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deformable elements which, when the air-bag is inflated, are on the side of the air-bag directed away from the A-Pillar.

Preferably the elongate elements are substantially parallel.

5

Conveniently the opposed ends of the elongate elements are retained by retainers.

Preferably each retainer is a pocket.

10

Conveniently each pocket is provided on a flap that extends from one side of the air-bag.

Alternatively each pocket is formed on the air-bag.

15

In an alternative embodiment each retainer is an aperture formed in part of the air-bag.

Conveniently each elongate element has opposed ends passed through
20 respective said apertures, the ends being enlarged.

Preferably when the air-bag is inflated, there is free space between each elongate element and the inflated air-bag.

25

Advantageously the air-bag defines a plurality of substantially parallel cells.

Conveniently the air-bag is connected to the motor vehicle by three spaced-apart anchoring points, the anchoring points being spaced apart horizontally and vertically.

- 5 In one embodiment at least one anchoring point is constituted by an element movable along a rail.

Advantageously the air-bag constitutes a main inflatable area having a laterally extending gas flow duct, there being a web extending between the
10 main inflatable area and the gas flow duct to enhance stability of the air-bag.

In an alternative embodiment the gas generator is positioned inside the air-bag.

- 15 Conveniently the air-bag is secured to the motor vehicle by anchoring means which secure the gas generator to the vehicle.

The invention also provides an air-bag for an arrangement as described above, the air-bag being inflatable and being provided with a plurality of said
20 elongate deformable elements, the opposed ends of which are retained by retainers on the air-bag.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be
25 described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a plan view of an air-bag, to form part of an air-bag arrangement in accordance with the present invention, in an initial condition,

FIGURE 2 is a view similar to that of Figure 1 illustrating the air-bag in a further condition,

5 FIGURE 3 is a view of the air-bag, in the condition shown in Figure 2, with the provision of slats,

FIGURE 4 is a sectional view taken on the line IV-IV of Figure 3,

10 FIGURE 5 is a view showing the air-bag of Figures 1 to 4 in position adjacent an A-Pillar of a motor vehicle,

FIGURE 6 is a side view of the arrangement as shown in Figure 5,

15 FIGURE 7 is a diagrammatic view illustrating the position of fixing points for the air-bag,

FIGURE 8 is a side view, corresponding to Figure 6, illustrating an alternative embodiment of the invention,

20

FIGURE 9 is a diagrammatic view of a fixing point present in the embodiment shown in Figure 8,

FIGURE 10 is a view corresponding to Figure 5 illustrating a modified
25 embodiment of the invention,

FIGURE 11 is a view corresponding to Figure 3 illustrating an alternative embodiment of the invention, and

FIGURE 12 is a sectional view taken on the line XII-XII of Figure 11.

In all of the figures the air-bag is shown in the inflated condition to facilitate a ready understanding of the invention.

5

As will become clear from the following description, the air-bag of the present invention is provided with a plurality of elongate plastically deformable elements or slats. In the described embodiment the slats are supported so that they extend in front of and spaced from the inflated part of the air-bag. Thus
10 the head of a pedestrian striking the inflated air-bag arrangement will actually impact with the slats, and will deform the slats as the slats bend inwardly. This bending of the slats will absorb energy. Also, the slats will act to spread the load experienced by the slats over the inflated air-bag. The air-bag will become compressed and the slats will, in addition to being deformed, yield due to the
15 compression of the air-bag.

Referring initially to Figure 1, an air-bag 1 is illustrated. The air-bag 1 is formed from two super-imposed layers of fabric. In the illustrated embodiment the layers of fabric define a first substantially rectangular area 2,
20 in which is defined, by means of seams, two substantially parallel in spaced-apart inflatable chambers 3, 4. At one side the lower edge of the rectangular area 2 is extended, 5, and this part of the rectangular area defines a gas flow duct 6. It is thus to be appreciated that gas may flow through the gas flow duct 6 into the two chambers 3, 4, which inflate to form two substantially cylindrical
25 vertically extending chambers.

At each side of the rectangular area 2 there is provided a projecting flap 7, 8. Each flap 7, 8, is formed from two super-imposed layers of fabric, one layer of fabric being slightly wider than the other. The layers of fabric are

inter-connected by stitching 9 which forms a plurality of retainers in the form of pockets 10.

The flaps 7, 8 are shown in Figure 1 as being folded outwardly to extend away from the area 2 of the air-bag that contains the chambers 3, 4, and in Figure 2 the flaps are shown folded inwardly, with the flaps 7, 8, thus overlying the inflated chambers 3, 4. Figure 2 shows that the layer of fabric forming the flaps 7, 8, which is immediately adjacent the inflated chambers 3, 4, has a greater width than the area of fabric which is further away from the inflated chamber.

The pockets 10 formed in the flaps 7, 8, serve as retainers to retain the ends of elongate plastically deformable elements or slats 11. In the illustrated embodiment, when the flaps 7 and 8 are folded inwardly in the position shown in Figure 2, each flap presents six pockets 10, directed towards corresponding pockets provided on the other flap. As shown in Figure 3, six slats 11 are provided, the opposed ends of each slat being retained by co-aligned pockets 10 in the flaps 7 and 8. The slats 11 are evenly spaced and are parallel.

As can be seen most clearly from Figure 4, when the air-bag is inflated, the central part of each slat 11 extends in front of a space 12 which is defined between the inflated cells 3 and 4 of the air-bag 1.

The air-bag 1 is to be mounted on a motor vehicle in such a position that, as shown in Figure 5, when the air-bag is inflated, the air-bag extends upwardly from a position adjacent the lower part of a windscreen 13, to overlie part of the A-Pillar 14. The slats 11 are on the side of the air-bag 1 directed away from the A-Pillar. The air-bag 1 may initially be stored beneath the rear-most part of the hood or bonnet, and the hood or bonnet may be provided with

means adapted to raise the rear-most part of the hood or bonnet in response to an accident with a pedestrian being sensed, thus permitting the air-bag 1 to move swiftly to the operative inflated position illustrated in Figure 5.

5 Figures 6 and 7 illustrate more clearly the manner in which the air-bag 1 is mounted to the motor vehicle having a windscreen located above a scuttle.

 The lower-most part of the air-bag 1 in the presently described embodiment is connected by means of two horizontally spaced-apart anchoring
10 elements 15, 16, which may be straps, to part of the scuttle and, by means of a centrally located somewhat higher anchoring point 17 to another point on the scuttle. The air-bag is thus connected to the scuttle by three horizontally and vertically spaced-apart anchoring points which will provide the air-bag with a significant degree of stability, and which will also help ensure that the air-bag
15 is in the desired position or orientation when the air-bag is fully inflated.

 Figure 8 illustrates a modified embodiment of the invention in which the upper-most anchoring point 17 of the air-bag 1 is connected to a slider 18 adapted to slide along an appropriately formed channel 19 that is located in part
20 of the scuttle. An arrangement of this type will enable the air-bag itself to occupy a minimum space when the air-bag is in the initial stored position.

 Figure 10 illustrates a further modified embodiment of the invention in which the air-bag 1 is provided with an additional triangular web 20 which
25 extends between the rectangular portion 2 of the air-bag, and the laterally projecting portion 5 which incorporates the gas flow duct 6. The triangular web 20 will impart added stability to the air-bag.

Referring now to Figure 11, in another modified embodiment of the invention, instead of providing retainers in the form of pockets on separate flaps, retainers for the slats are constituted by a plurality of apertures 21 provided at each vertical side edge of the rectangular area 2 of the air-bag 1.

5 The slats 22 of this embodiment of the invention are again elongate elements formed of a plastically deformable material such as aluminium, but the slats 22 are provided with enlarged ends 23 to prevent the slats becoming inadvertently released from the retainers constituted by the apertures 21. Again, the slats are evenly spaced and parallel.

10

In this embodiment of the invention slats may initially be linear or straight, and, on inflation of the air-bag 1, the slats may become arcuate or "bowed" due to the inflation of the chambers 3 and 4 of the air-bag as shown most clearly in Figure 12.

15

It is to be noted that in the described embodiments of the invention, there is always some "free space" between the slats and the inflated air-bag, thus enabling the slats to be deformed, at least to a limited extent, when subjected to an impact from a pedestrian, without any compression of the
20 inflated air-bag.

Because the slats are provided, and because the slats will give an energy-absorbing and load distributing effect, it is not necessary to vent the air-bag in any way, and consequently the air-bag may remain inflated for a
25 relatively long period of time which, in a pedestrian impact situation, is desirable.

In different embodiments of the invention the air-bag may be mounted in position in any convenient way, using straps or other fixing means.

In the described embodiment of the invention, a separate gas generator is provided adapted to supply gas to the air-bag through the laterally extending gas flow duct 6. However, it is envisaged that in embodiments of the invention, the gas generator may be located within the air-bag itself, thus making the gas flow duct 6 superfluous. In such an embodiment, the gas generator may be held in position by the same anchoring means that secure the air-bag to the scuttle. Whilst, in the first described embodiment, the retainers are in the form of pockets present on flaps extending from the main inflatable region of the air-bag, in an alternative embodiment the pockets could be formed directly on the inflatable region of the air-bag itself.

In the present Specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

CLAIMS:

- 5 1. An air-bag arrangement on a motor vehicle, the air-bag arrangement incorporating an air-bag and a gas generator to inflate the air-bag, the air-bag being configured and located so that when the air-bag is inflated, it extends at least partially over an A-Pillar of the motor vehicle, the air-bag being provided with a plurality of elongate deformable elements which, when the air-bag is
10 inflated, are on the side of the air-bag directed away from the A-Pillar.
2. An arrangement according to Claim 1 wherein the elongate elements are substantially parallel.
- 15 3. An arrangement according to Claim 1 or 2 wherein the opposed ends of the elongate elements are retained by retainers.
4. An arrangement according to Claim 3 wherein each retainer is a pocket.
- 20 5. An arrangement according to Claim 4 wherein each pocket is provided on a flap that extends from one side of the air-bag.
6. An arrangement according to Claim 4 wherein each pocket is formed on the air-bag.
- 25 7. An arrangement according to Claim 3 wherein each retainer is an aperture formed in part of the air-bag.

8. An arrangement according to Claim 7 wherein each elongate element has opposed ends passed through respective said apertures, the ends being enlarged.
- 5 9. An arrangement according to any one of the preceding Claims wherein, when the air-bag is inflated, there is free space between each elongate element and the inflated air-bag.
- 10 10. An arrangement according to any one of Claims 1 to 9 wherein the air-bag defines a plurality of substantially parallel cells.
11. An arrangement according to any one of the preceding Claims wherein the air-bag is connected to the motor vehicle by three spaced-apart anchoring points, the anchoring points being spaced apart horizontally and vertically.
- 15 12. An arrangement according to Claim 11 wherein at least one anchoring point is constituted by an element movable along a rail.
- 20 13. An arrangement according to any one of the preceding Claims wherein the air-bag constitutes a main inflatable area having a laterally extending gas flow duct, there being a web extending between the main inflatable area and the gas flow duct to enhance stability of the air-bag.
- 25 14. An arrangement according to any one of Claims 1 to 12 wherein the gas generator is positioned inside the air-bag.
15. An arrangement according to Claim 14 wherein the air-bag is secured to the motor vehicle by anchoring means which secure the gas generator to the vehicle.

16. An air-bag for an arrangement according to any one of the preceding Claims, the air-bag being inflatable and being provided with a plurality of said elongate deformable elements, the opposed ends of which are retained by
- 5 retainers on the air-bag.

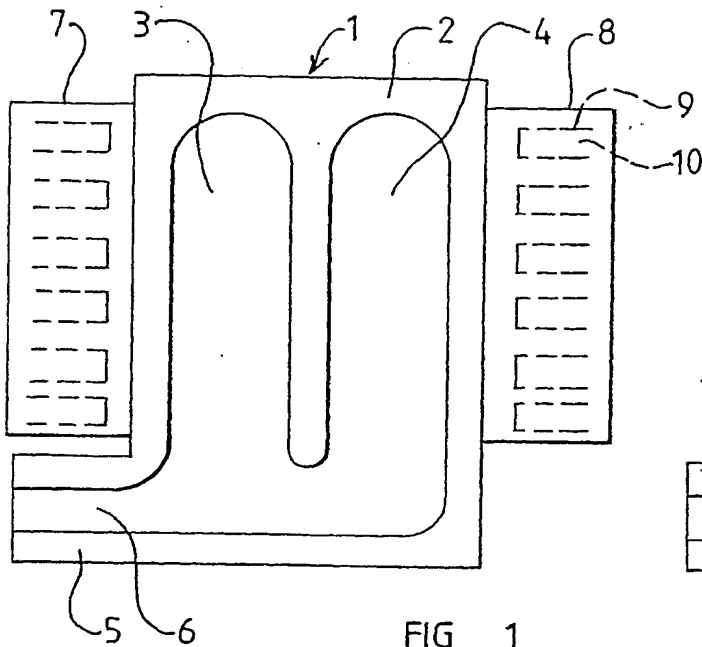


FIG 1

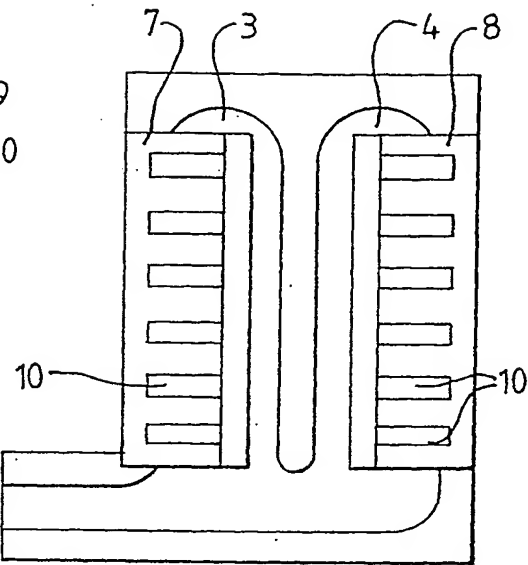


FIG 2

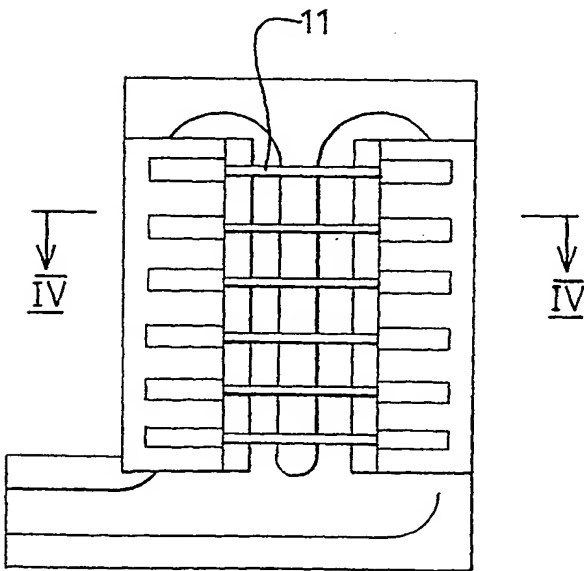


FIG 3

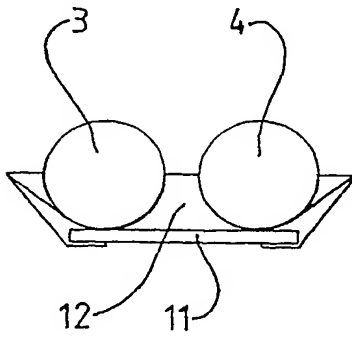


FIG 4

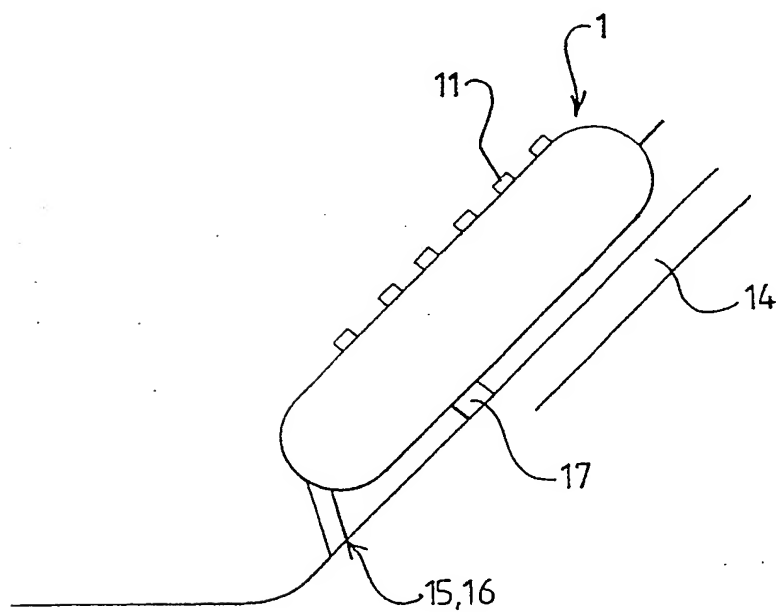
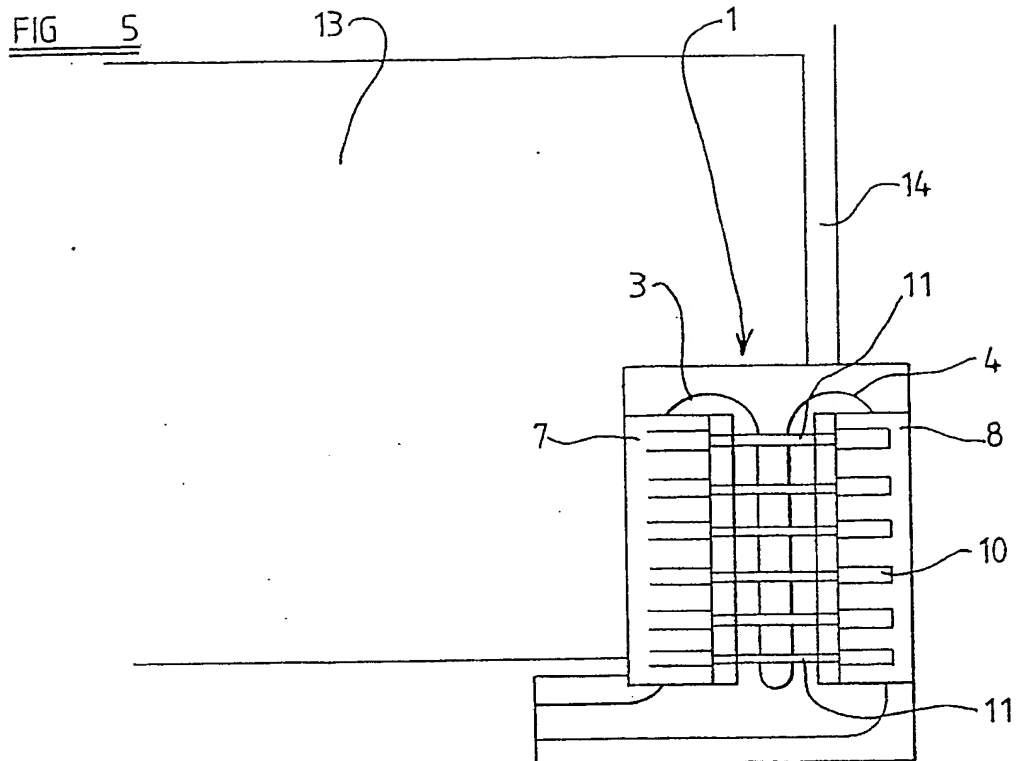


FIG 6

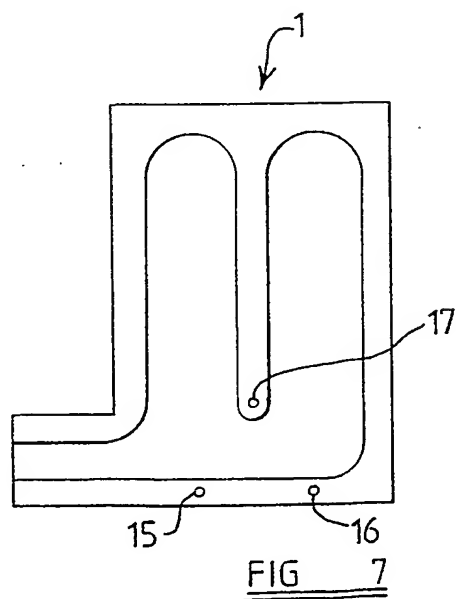


FIG 8

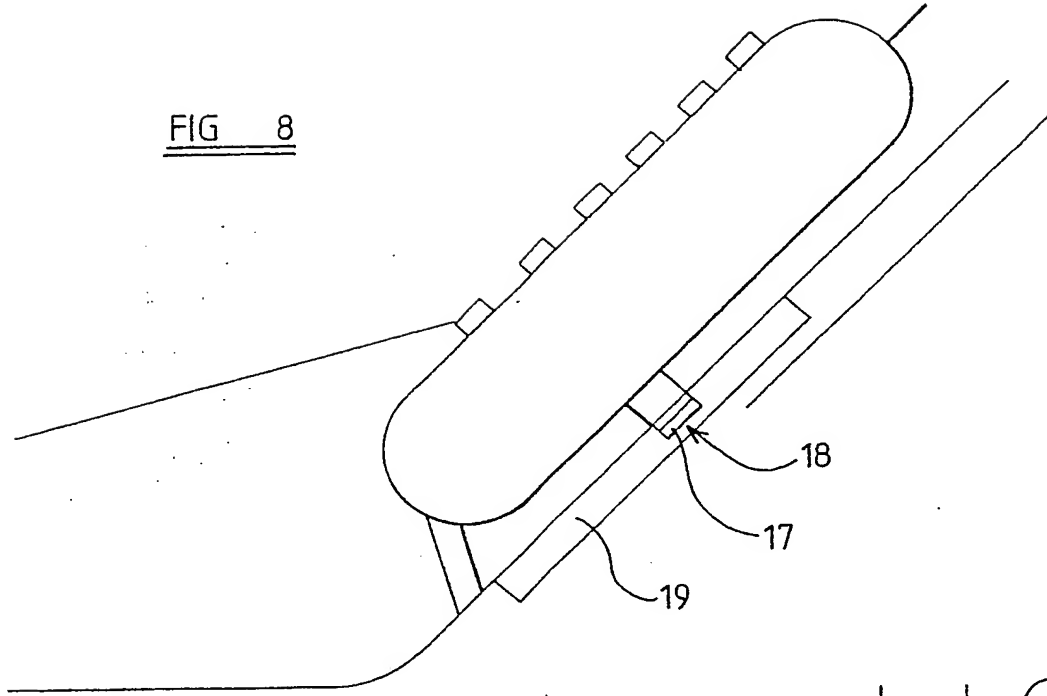


FIG 9

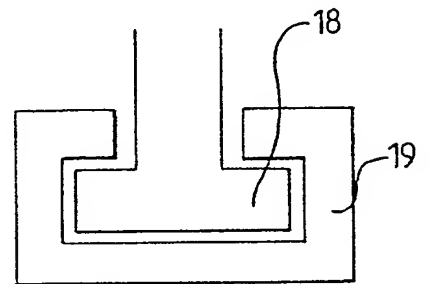
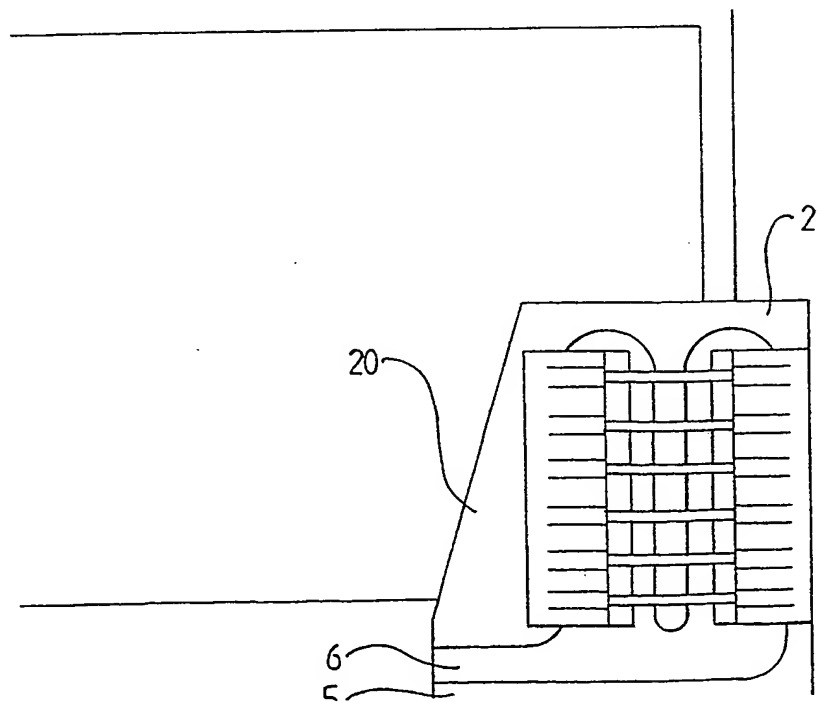
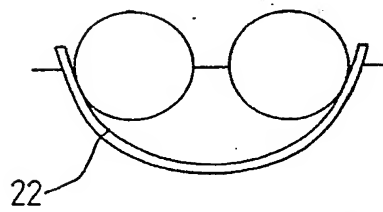
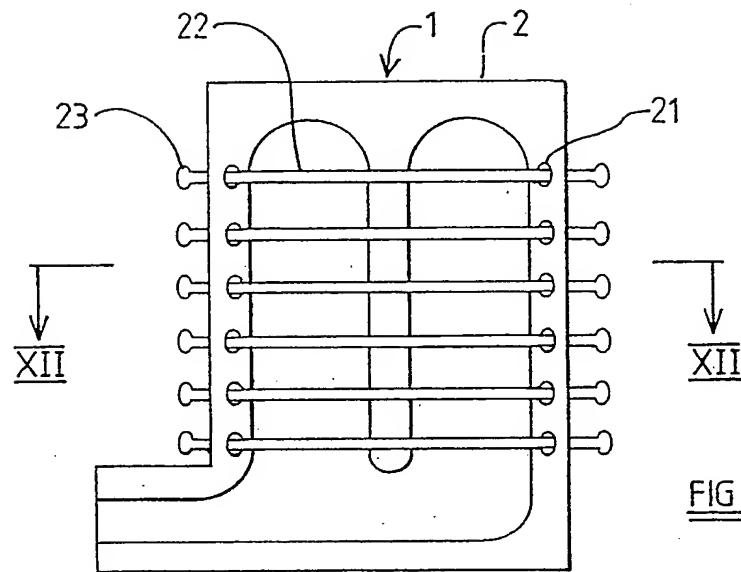


FIG 10





INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/01563

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 21/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 19745873 A1 (VOLKSWAGEN AG), 22 April 1999 (22.04.99) --	1
A	DE 19803165 A1 (BAYERISCHE MOTOREN WERKE AG), 29 July 1999 (29.07.99) --	1
A	DE 19948181 A1 (VOLKSWAGEN AG), 12 April 2001 (12.04.01) --	1
A	EP 0967128 A2 (NISSAN MOTOR CO., LTD.), 29 December 1999 (29.12.99) --	1

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

11 December 2002

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/01563

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 07108903 A (TOYOTA MOTOR CORP), 25 April 1995 (25.04.95) --	1
A	JP 07156749 A (TOYOTA MOTOR CORP AISIN SEIKI CO LTD), 20 June 1995 (20.06.95) --	1
A	JP 10217903 A (HONDA MOTOR CO LTD), 18 August 1998 (18.08.98) -- -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/10/02

International application No.

PCT/SE 02/01563

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE	19745873	A1	22/04/99	NONE	
DE	19803165	A1	29/07/99	NONE	
DE	19948181	A1	12/04/01	NONE	
EP	0967128	A2	29/12/99	JP 2000079859 A US 6182782 B	21/03/00 06/02/01
JP	07108903	A	25/04/95	NONE	
JP	07156749	A	20/06/95	NONE	
JP	10217903	A	18/08/98	NONE	